494309

ISSI Consulting Group
999 18th Street, Suite 1450
Denver, CO 80202
ph 303.292.4142 • fax 303.292.4926

U.S. SBA 8(a) certified
postmaster@issiinc.com
www.issiinc.com

MEMORANDUM

To: Chris Weis, Bonnie Lavelle

From: Mary Goldade, Bill Brattin

Date: October 18, 1999

RE: Vasquez Boulevard and I-70 Site
Residential Garden Vegetable Analysis Techniques and Detection Limits

cc: Project files

The Residential Garden Vegetable Sampling and Analysis Plan submitted to you on September 16, 1999 recommends a method detection limit (MDL) of 0.05 mg/kg dry weight (dw) for both arsenic and for lead. ATSDR has recommended that a lower detection limit for both arsenic and lead be employed. In order to help evaluate whether this recommendation should be followed, we have attached the calculations we used to identify the MDLs needed to support a risk assessment for ingestion of arsenic and lead in garden vegetables.

PART A: ARSENIC

Calculations

The calculations for arsenic are shown in Attachment 1. As seen, an RME risk of 1E-4 risk corresponds to an arsenic concentration of 0.35 mg/kg dw. In order to ensure that values at the ND level do not become risk drivers, the target MDL is set at 1/10 this value (0.035 mg/kg dw). An MDL of 0.05 mg/kg dw corresponds to an RME risk level of about 1.4E-05. If the detection limit were 0.05 mg/kg dw, and if one-half the detection limit were used for a non-detect, a sample that was below detection limits would correspond to a risk of about 7E-06. As stated in the plan, we anticipate that a detection limit of 0.05 mg/kg dw can be met using ICP-MS

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the plan, we anticipate that a detection limit of 0.05 mg/kg dw can be met using ICP-MS instrumentation. GFAA may also approach this MDL.

Issues

Two tactical issues should be considered in deciding if this MDL is acceptable:

1) Do you wish to be able to measure arsenic at levels lower than the 1E-05 risk level? If so, then a more sensitive analytical method is needed.

2) Do you wish to measure only inorganic arsenic (rather than total arsenic) in the vegetables (since inorganic arsenic is the toxic form) ? If so, a different analytical method is needed.

Recent publications by Schoof *et al.* (1999) and Yost *et al.* (1998) investigated total and inorganic arsenic levels in a variety of foods. These workers found that detection limits of about 1-4 ug/kg ww (0.001-0.004 mg/kg ww) can be achieved using NaOH or HCl digestion coupled with hydride generation. Thus, this method could be used in order to achieve either a lower detection limit for total arsenic and/or to quantify inorganic arsenic only. However, the cost to measure total arsenic by GFAA is approximately $30 per sample whereas the cost is about $200 per sample for the hydride method.

PART B: LEAD

Calculations

Risks from lead in home grown garden vegetables will be assessed using the IEUBK model. Using all default inputs to the model, it can be calculated that an average concentration of lead in home grown garden vegetables of about 0.02 ug/g wet weight (about 0.05 mg/kg dw) will yield increments in average daily absorbed dose that are fairly small (about 0.1 ug/dL in blood lead level). Thus, this value is considered acceptable. However, to be fully negligible, a MDL of about 0.01 mg/kg ww (about 0.025 mg/kg dw) would be required.

Issues

If an analytical method such as ICP-MS is selected to provide a lower detection limit for arsenic in vegetables (see above), it is expected that this will also result in a low detection limit for lead. However, if a hydride method is used for arsenic, lead will have to be analyzed by another method, thereby increasing the cost.

Please feel free to contact me at (303) 292-4142 if there are any issues or points that require additional discussion.

ATTACHMENT 1

Attachment 1: Detection Limit for Arsenic in Home Grown Garden Vegetables

BASIC EQUATIONS

Risk = C (mg/kg ww) * HIF * oSF

PRG (mg/kg ww) = (Target Risk)/(HIF * oSF)

HIF = (IR/BW) * F * (EF/365) * (ED/70)

DL (mg/kg ww) = PRG / 10

DL (mg/kg dw) = DL (mg/kg ww) / R

INPUTS

RME Exposure Factors	
IR (g ww/d)	200
F	0.4
BW (kg)	70
ED (d)	350
EF (y)	30

Cancer Slope Factor	
1 / (mg/kg*d)	1.5

Target Risk	1.00E-04

Dry wt/wet wt ratio (R)	0.4

CALCULATIONS

HIF	4.70E-04	kg ww/kg/day
PRG (1E-04)	0.142	mg/kg ww
	0.355	mg/kg dw
DL (PRG/10)	0.035	mg/kg dw